Site Index

The Quest for Measures of Site Condition in a Military Installation Context

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The Problem
(re-stated)

Multiple teams of researchers were involved in field research on Fort Benning, each with a different set of research sites. The goal was to obtain comparable data from all research sites, in order to understand, characterize and help "manage" the impacts of mission and land management activities on ecosystem processes. However, due to a lack of information on mission use histories for locations across the base, we were unable to accurately place each research site along a mission use spectrum. So, an alternative approach was needed to make comparisons across all these field research sites.

Our Dilemma

It was not difficult to agree on certain conditions, for example:

This shows evidence of heavy disturbance

SERDP
Strategic Environmental Research and Development Program
Improving Mission Readiness Through Environmental Research

US Army Corps of Engineers

As does this

And this

All of these were called “high” (disturbance) or “heavy” (use)

by the research teams

And we may agree that this shows little or no disturbance

SERDP
Strategic Environmental Research and Development Program
Improving Mission Readiness Through Environmental Research

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The same with this site

All of these were called “light” or “none” by the research teams

The truth is that different teams placed these sites in ALL classes, from low to high!

Now you see a little more of the problem facing SEMP researchers

Problem Defined

- **Ends of the scale are pretty easy**
- **Intermediate classes VERY hard to define**
- **“Spacing” of different classes unclear**
- **Almost all study sites were intermediate!**
- **Working definitions are usually fuzzy, though workable…here, an example from a manuscript:**
  - **High impact sites were characterized by current landscape-scale training activities with mechanized infantry and supporting tactical elements.**
  - **Medium sites had experienced past military activities, but current use was light, consisting mostly of foot traffic confined to existing roads and trails.**
  - **Light sites had no evidence of military activities, but like the others were subjected to agricultural land-use prior to the 1940s.**

Proposed Solution

- **Develop an “index” or measure of site quality to be applied consistently across all sites for all teams**
- **Should work across the full range of local landscapes (one for terrestrial, another for aquatic sites)**
- **Ought to utilize actual values rather than subjective classes insofar as possible**
- **Should contain elements with clear biological relevance**

Our Advisory Committee Proposed Terrestrial Elements

- 1. Vegetation structure (i.e., vertical layer, as well as horizontal distribution) and composition of communities by ecological group (as defined in Fort Benning's INRMP)
- 2. Soil compaction (may correlate with changes in soil horizon profile)
- 3. Microfloral populations (applies to both terrestrial and aquatic systems)
- 4. Plant productivity (applies to both terrestrial and aquatic systems)
- 5. Soil and sediment carbon
- 6. Plant (Raunkier) life form for communities
- 7. Historical land use and current road/trail networks? (both qualitative and quantitative)
- 8. Remotely-sensed surface cover by ecological group

Development Process

- Started with advisory committee's suggestions
- Team Leaders reviewed proposed parameters
- TLs asked to propose additional parameters
  - Several were proposed
- Team Leader-Project Manager conference call
- Distributed spreadsheet with potential parameters – now 13 in all, with added candidates
- Team Leaders ranked parameters on 1-5 scale
- Seven ranked at >3.75 appeared highest value

Candidate Parameters

(after we added new elements from research teams)

1. Vegetation Structure
2. Soil Compaction (bulk density)
3. Microflora
4. Plant Productivity
5. Soil/sediment Carbon
6. Raunkier Life Form
7. Historical Land Use
8. Surface cover (via RS)
9. A-Horizon Soil Depth
10. Nutrient Leakage
11. Ant Community Structure
12. Species Composition
13. Soil/Sediment Nitrogen

Parameters Ranked

Element	Score
A-Horizon Soil Depth	*4.8*
Soil/sediment Carbon	*4.6*
Soil Compaction (bulk density)	*4.4*
Vegetation Structure	*4*
Species Composition	*4*
Historical Land Use (?)	3.8
Soil/Sediment Nitrogen	*3.75*
Plant Productivity	3.6
Surface cover (via RS)	*3.2*
Microflora	2.4
Nutrient Leakage	2.4
Ant Community Structure	2.33
Raunkier Life Form	2.2

Proposed for Test of Index Development

Canopy cover

(Added by consensus)

Development of the Index Plan

- First plan was to use only top 5 items
- Soil N was moved up since most analyses provide C/N in single step
- Surface cover moved up, and canopy cover added as simple and relevant
- New full set includes 8 parameters
- Agreed that these were the “easy to use” set, not necessarily the “best” technically

Some Modifications Needed

- **In practice, some elements resisted quantification**
  - **Past land use unavailable on the scale needed**
  - **Military use known only as general patterns, not site-specific on the scale needed**
  - **Present cover so variable that no patterns were evident**
  - **Vegetation structure and species composition not immediately quantifiable in simple terms**
- **Alternative measures used for some things**
  - **Penetrometer substituted for bulk density**

First Full Test
April-July 2003

- **Forty sites selected**
  - **Widest possible range of landscapes**
  - **Included ecologically sensitive areas**
  - **Included most-heavily used military areas**
- **Twenty-two sites had been previously studied by SEMP teams**
  - **Had been classified “visually”as Low, Med, or High**
- **Five parameters to be collected**
  - **A-horizon**
  - **Compaction**
  - **Vegetation (4 elements)**
  - **Soil C and N**

Initial Results
(as of 01 Aug 03)

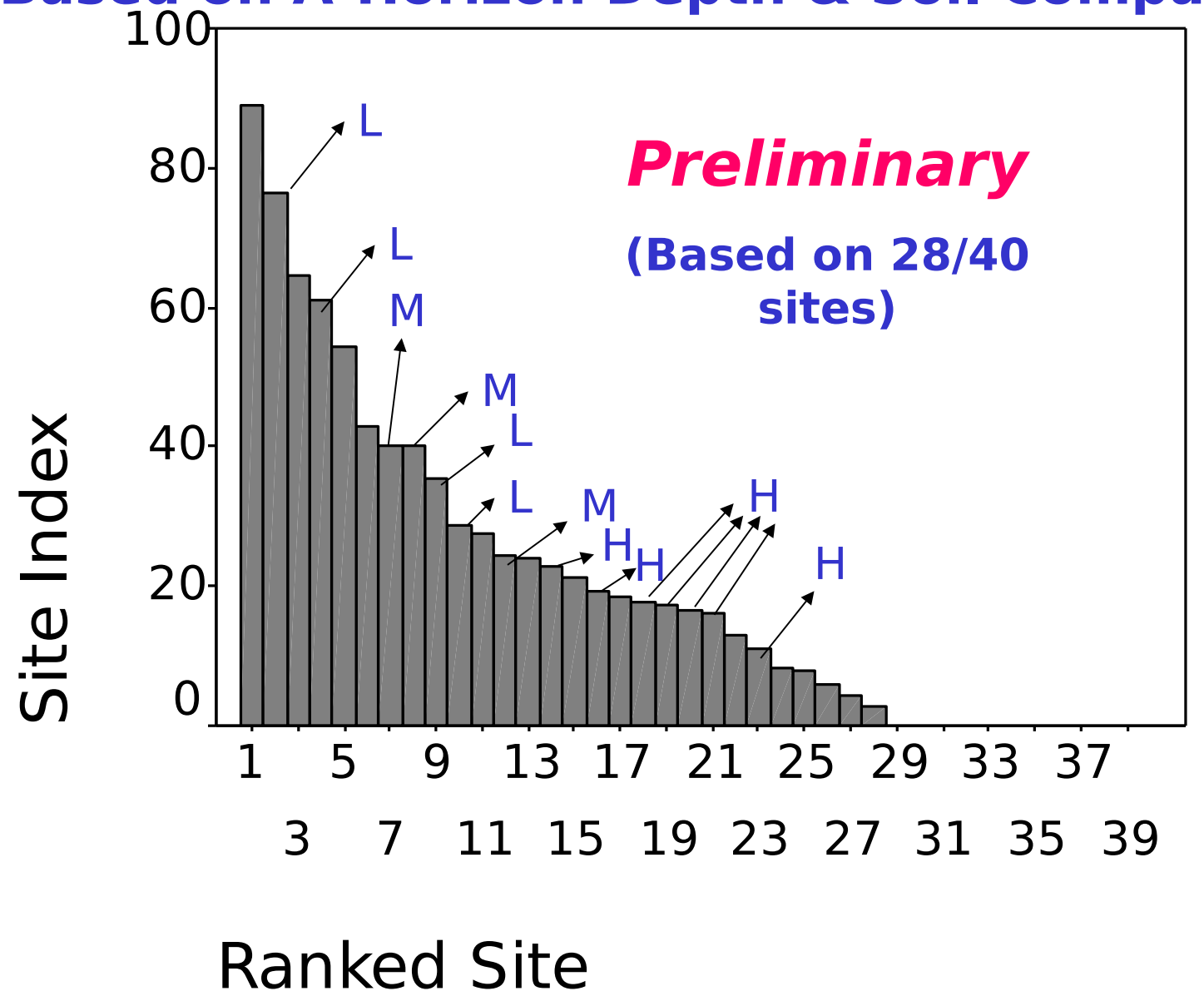
- **Data not quite complete**
  - **Weather prevented some collections**
  - **Military training safety closures prevented others**
  - **Missing elements identified July 03**
  - **Collections scheduled for Aug-Sep 03**
  - **Soil measures require laboratory time**
  - **Should be complete by 30 Sep 03**
- **Preliminary results include only A-horizon and compaction**

Index Development

- **Ranked from lowest to highest value**
  - **Some values (for A-horizon) were truly zero**
  - **1600 A-horizon values**
  - **8000 penetrometer readings**
- **Ranges were re-scaled so that the mean value for each parameter equaled 100**
  - **Values then divided by two so each range was normalized**
  - **Direction of range adjusted where necessary**
- **Maximum value per element thus = 100**
- **For two elements, add and divide by 2**
- **Maximum possible index thus = 100**

Site Index

Based on A-Horizon Depth & Soil Compaction



What's Next?

- Complete sample collection
- Reduce data on hand
- Complete full set for two elements
- Add other elements as completed (and evaluate how many elements actually add value to index)
- Review results for credibility
- Report findings to Advisory Committees, publish in peer journals
- Test results at other locations
  - Across Sandhills in similar settings
  - At other installations in southeast
- Possible modification for other systems and regions
- Apply the same process to develop an Aquatic Site Condition Index